

Support information for:

Can China Comply With Its 12th Five-Year Plan on Industrial Emissions

Control: A Structural Decomposition Analysis

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The Supporting Information provides additional information about: (1) the classification of economic sectors in monetary input-output tables of China; (2) Changes of factors (such as pollution treatment facilities and its capacity, pollutants emissions, pollutants generation intensity and pollutants emission ratio) between 2005 and 2010; (3) data of outdated production facilities being shut down; (4) comparison of some economic structure data between 2005 and 2010 and prediction of GDP during 12th FYP; (5) structural decomposition results between 2005 and 2010 at the sector level; and (6) sensitivity analysis.

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1. Reclassification of economic sectors

Table S1 Mapping between the 41 sectors in Original MIOTs and the 26 sectors in adjusted MIOTs

NO.	Sectors in China MIOTs	Sectors in adjusted MIOTs	Sector abbreviations
1	Agriculture	Agriculture	Agriculture
2	Coal Mining	Coal Mining	CoalMining
3	Petroleum and natural gas Mining	Petroleum and natural gas Mining	CrudeOilGas
4	Metal Ore Mining	Metal Ore Mining	MetalOre
5	Nonmetallic and other ores	Nonmetallic and other ores	NonmetalOre
6	Food and tobacco	Food and tobacco	FoodTobacco
7	Textiles	Textiles	Textiles
8	Clothing and Leather	Clothing and Leather	ClothingLeather
9	Wood processing and Furniture	Wood processing and Furniture	WoodFurniture
10	Papermaking and printing	Papermaking and printing	PaperPrinting
11	Petroleum processing and coking	Petroleum processing and coking	PetrolCoking
12	chemical products	chemical products	Chemical
13	nonmetallic mineral products	nonmetallic mineral products	NonmetalProducts
14	metal smelting and rolling	metal smelting and rolling	MetalSmelt
15	Metal Products	Metal Products	MetalProducts
16	General and Special purpose machinery	General and Special purpose machinery	GenSpecMch
17	Transport equipment	Transport equipment	Transportequip
18	Electrical equipment	Electrical equipment	ElectricalEquip
19	Computer and electronic equipment	Computer and electronic equipment	ElectronicEquip
20	Measuring instruments	Measuring instruments	MeasureInstru
21	Artwork and others	Artwork and others	ArtworkOthers
22	electric and heat power	electric and heat power	ElectricHeatpower
23	Fuel gas supply	Fuel gas supply	GasSupply
24	Water supply	Water supply	WaterSupply
25	Construction	Construction	Construction
26	Transport and Storage		
27	Post		
28	Information and data processing		
29	Wholesale and Retail		
30	Accommodation and Catering		
31	Financial Intermediation		
32	Real Estate		
33	Leasing and Business		
34	Research and Experimental Development		
35	Comprehensive Technical Services		
36	Management of Water , Environment and Public Facilities	Services	Services
37	Services to Households and Other Services		
38	Education		
39	Health , Social Security and Social Welfare		
40	Culture, Sports and Entertainment		
41	Public Management and Social Organization		

Table S2 Projection of 39 industrial sectors in pollutants data to 23 adjusted MIOTs sectors

NO.	Sector in industrial pollutants data	Merged sectors in adjusted MIOTs
1	Coal Mining	Coal Mining
2	Petroleum and natural gas Mining	Petroleum and natural gas Mining
3	Ferrous metal ores Mining	Metal Ore Mining
4	Nonferrous metal ores Mining	
5	Nonmetallic ores Mining	Nonmetallic and other ores
6	Other ores Mining	
7	Food processing	Food and tobacco products
8	Food production	
9	Beverages	
10	Tobacco	
11	Textiles	Textiles
12	Clothes	Clothing and Leather
13	Leather, fur and feather	
14	Wood processing	Wood processing and Furniture
15	Furniture	
16	Papermaking	Papermaking and printing
17	Printing and recording media	
18	Cultural articles	
19	Petroleum processing and coking	Petroleum processing and coking
20	Raw chemical materials	Chemical products
21	Medicines	
22	Chemical fibers	
23	Rubber	
24	Plastics	
25	Nonmetallic mineral products	Nonmetallic mineral products
26	Ferrous metals smelting and rolling	Metal smelting and rolling
27	Nonferrous metals smelting and rolling	
28	Metal products	Metal products
29	General purpose machinery	General and Special purpose machinery
30	Special purpose machinery	
31	Transport equipment	Transport equipment
32	Electrical equipment	Electrical equipment
33	Computer and electronic equipment	Computer and electronic equipment
34	Measuring instruments	Measuring instruments
35	Artwork and others	Artwork and others
36	Waste recycling	
37	electric and heat power	electric and heat power
38	Fuel gas supply	Fuel gas supply
39	Water supply	Water supply
40	Other industries	(deleted)

2. Changes of factors between 2005 and 2010

Table S3 Pollution treatment facilities and its capacity between 2005 and 2010

	unit	2005	2006	2007	2008	2009	2010
Number of treatment facilities for industrial waste water	10 ⁴ set	6.92	7.58	7.82	7.87	7.70	8.03
Capacity of treatment facilities for industrial waste water	10 ⁸ tons/day	1.63	1.96	2.21	2.29	2.27	2.48
Treatment plants for urban waste water	unit	764	939	1258	1692	2192	2881
Treatment capacity for urban waste water	10 ⁴ tons/day	5220	6370	7579	9079	10477	12331
Number of industrial desulfurization facilities	10 ⁴ sets	2.26	2.45	2.47	2.73	2.70	2.66
Capacity of industrial desulfurization facilities	10 ⁴ ton/h	1.29	1.61	2.44	2.40	2.54	3.14
Capacity of thermal power	10 ⁸ kwh	3.91	4.84	5.56	6.03	6.51	7.10
Desulfurized capacity of thermal power	10 ⁸ kwh	0.53	1.46	2.66	3.63	4.61	5.78

Data sources: *Annual Statistic Report on Environment in China 2010¹*.

Table S4 Changes of major pollutants emissions by sectors during 11th FYP (unit: 1000 tons)

Sectors	COD			NH ₃ -N			SO ₂			NO _x		
	2005	2010	changes	2005	2010	changes	2005	2010	changes	2006	2010	changes
CoalMining	57.4	100.2	42.8	2.2	5.7	3.5	210.4	160.3	-50.2	87.1	73.9	-13.1
CrudeOilGas	16.7	32.6	15.9	2.4	1.0	-1.4	32.2	35.6	3.4	29.5	27.2	-2.4
MetalOre	75.2	42.2	-33.0	0.9	3.4	2.5	110.2	164.0	53.8	25.7	22.2	-3.6
NonmetalOre	20.7	8.7	-12.0	1.6	0.4	-1.2	59.3	42.7	-16.6	44.2	19.1	-25.1
FoodTobacco	1020	843.0	-177.1	82.8	38.1	-44.8	369.1	406.8	37.6	210.5	246.4	35.9
Textiles	298.6	300.6	2.0	16.6	17.4	0.8	296.2	247.2	-49.0	152.4	129.3	-23.1
ClothingLeather	21.4	77.5	56.1	1.5	5.8	4.3	36.6	25.2	-11.3	19.1	14.3	-4.8
WoodFurniture	28.8	15.3	-13.5	2.2	0.6	-1.6	51.6	34.8	-16.8	17.9	17.1	-0.7
PaperPrinting	1602.6	954.7	-647.9	42.5	25.2	-17.3	436.4	512.3	75.9	233.7	238.4	4.7
PetrolCoking	83.3	81.7	-1.6	16.3	7.7	-8.6	708.5	635.3	-73.2	218.8	347.2	128.4
Chemical	810.3	695.6	-114.7	234.1	87.8	-146.3	1404.4	1295.2	-109.1	732.3	728.7	-3.6
NonmetalProducts	52.8	31.2	-21.7	1.5	2.0	0.6	1783.6	1686.2	-97.5	836.0	1593.8	757.8
MetalSmelt	210.6	136.1	-74.4	31.3	15.3	-16.0	2129.4	2569.8	440.5	880.1	1157.6	277.5
MetalProducts	20.2	25.3	5.1	0.8	1.9	1.1	25.5	35.0	9.5	16.6	18.2	1.6
GenSpecMch	33.0	25.2	-7.9	3.3	1.9	-1.4	88.2	89.6	1.4	39.7	68.9	29.2
Transportequip	38.1	53.8	15.7	2.0	2.6	0.6	41.0	33.9	-7.1	54.1	37.0	-17.1
ElectricalEquip	9.6	12.8	3.2	0.3	0.7	0.4	27.2	13.5	-13.7	6.8	7.8	1.0
ElectronicEquip	16.7	28.6	11.9	1.0	2.7	1.7	17.0	6.5	-10.5	11.7	8.5	-3.1
MeasureInstru	9.4	4.0	-5.3	0.6	0.4	-0.2	13.0	1.4	-11.6	12.1	1.0	-11.1
ArtworkOthers	4.8	4.9	0.0	0.3	0.3	0.0	5.3	11.0	5.7	1.5	3.7	2.2
ElectricHeatpower	132.2	54.8	-77.3	5.5	4.7	-0.8	11671.7	8997.9	-2673.8	6622.7	8957.7	2335.0
GasSupply	9.5	2.7	-6.7	6.3	1.0	-5.3	18.8	20.1	1.3	6.6	10.8	4.2
WaterSupply	23.7	25.4	1.8	2.2	1.0	-1.2	5.3	2.1	-3.2	1.2	0.7	-0.5
total	4595.6	3556.9	-1038.7	457.9	227.4	-230.5	19540.9	17026.4	-2514.5	10260.3	13729.4	3469.1

Data sources: *Annual Statistic Report on Environment in China (2005 and 2010¹)*.

Table S5 Changes of major pollutants intensity by sectors during 11th FYP (unit: kg/10⁴ CNY)

Sectors	COD		NH ₃ -N		SO ₂		NO _x					
	2005	2010	2005	2010	2005	2010	2006	2010				
Agriculture	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00			
CoalMining	2.05	↓	1.12	0.02	↑	0.04	1.97	↓	0.99	0.65	↓	0.35
CrudeOilGas	2.13	↓	1.26	0.05	↑	0.06	1.99	↓	0.78	0.40	↓	0.22
MetalOre	4.11	↓	1.94	0.03	↑	0.05	5.78	↑	6.88	0.83	↓	0.21
NonmetalOre	0.68	↓	0.48	0.05	↓	0.01	5.52	↓	1.16	1.45	↓	0.35
FoodTobacco	11.65	↓	6.82	0.54	↓	0.22	1.96	↓	0.97	0.85	↓	0.42
Textiles	6.74	↓	5.49	0.15	↑	0.16	2.17	↓	1.09	0.93	↓	0.42
ClothingLeather	3.15	↓	2.06	0.04	↑	0.09	0.42	↓	0.14	0.17	↓	0.07
WoodFurniture	0.76	↓	0.31	0.03	↓	0.01	0.89	↓	0.28	0.26	↓	0.12
PaperPrinting	50.37	↓	26.55	0.50	↓	0.25	5.40	↓	3.65	2.28	↓	1.22
PetrolCoking	3.61	↓	1.83	0.54	↓	0.51	8.85	↑	9.72	1.38	↓	1.35
Chemical	5.76	↓	3.44	1.15	↓	0.57	5.97	↓	3.07	1.92	↓	0.86
NonmetalProducts	0.53	↓	0.20	0.01	-	0.01	12.63	↓	5.14	4.90	↓	4.04
MetalSmelt	1.12	↓	0.82	0.16	↓	0.07	17.32	↓	12.96	2.27	↓	1.48
MetalProducts	0.75	↓	0.35	0.01	↑	0.02	0.22	↓	0.19	0.12	↓	0.08
GenSpecMch	0.23	↓	0.10	0.02	↓	0.01	0.44	↓	0.22	0.17	↓	0.11
Transportequip	0.50	↓	0.21	0.02	↓	0.01	0.38	↓	0.09	0.41	↓	0.07
ElectricalEquip	0.22	↓	0.09	0.00	-	0.00	0.19	↓	0.05	0.04	↓	0.02
ElectronicEquip	0.22	↓	0.21	0.01	-	0.01	0.10	↓	0.02	0.05	↓	0.02
MeasureInstru	0.64	↓	0.18	0.03	↓	0.01	0.44	↓	0.03	0.35	↓	0.01
ArtworkOthers	0.13	↑	0.14	0.01	↓	0.00	0.12	-	0.12	0.03	-	0.03
ElectricHeatpower	1.18	↓	0.31	0.04	↓	0.02	59.70	↑	62.56	30.36	↓	20.68
GasSupply	6.95	↓	0.60	0.84	↓	0.07	3.04	↓	1.63	0.82	↓	0.51
WaterSupply	7.20	↑	7.81	0.37	↓	0.21	0.59	↓	0.14	0.10	↓	0.04
Construction	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00
Services	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00
Total	2.37	↓	1.45	0.14	↓	0.09	4.69	↓	4.10	1.72	↓	1.18

Method and data sources: The pollutant generation intensity of each sector are represented by the pollutant generation per unit of total output by sector (each sector' pollutant generation intensity= pollutant generation ÷ output). Each sectors' pollutant generation are from *Annual Statistic Report on Environment in China*; each sectors' outputs are from MIOTs used in our paper, which were all converted into 2010 constant prices on the basis of the producer price indices.

Table S6 Changes of major pollutants emission ratio by sectors during 11th FYP (unit: %)

Sectors	COD		NH ₃ -N		SO ₂		NO _x					
	2005	2010	2005	2010	2005	2010	2006	2010				
Agriculture	0.0	-	0.0	0.0	-	0.0	0.0	-	0.0			
CoalMining	20.6	↑	42.3	88.3	↓	71.1	78.8	↓	76.4	98.0	↑	99.1
CrudeOilGas	10.5	↑	20.8	60.5	↓	14.6	21.7	↑	36.9	98.5	↑	99.6
MetalOre	55.0	↓	20.0	95.2	↓	63.1	57.4	↓	22.0	93.5	↑	98.6
NonmetalOre	99.8	↓	32.9	100.0	↓	47.0	35.2	↑	66.4	99.7	↓	97.8
FoodTobacco	33.6	↓	20.1	59.1	↓	28.3	72.2	↓	68.6	94.8	↑	95.8
Textiles	25.2	↓	17.3	64.6	↓	35.3	77.4	↓	71.3	92.9	↑	97.6
ClothingLeather	5.8	↑	16.8	34.1	↓	30.3	75.5	↑	80.4	96.8	↑	98.2
WoodFurniture	53.5	↓	33.9	95.4	↓	52.5	81.8	↑	83.0	98.4	↑	99.3
PaperPrinting	28.5	↓	17.6	76.2	↓	50.0	72.5	↓	68.8	91.9	↑	95.9
PetrolCoking	12.8	↑	14.4	16.7	↓	4.9	44.3	↓	21.0	87.7	↓	82.4
Chemical	32.0	↓	22.2	46.2	↓	17.0	53.5	↓	46.4	86.7	↑	92.6

Sectors	COD		NH ₃ -N		SO ₂		NO _x	
	2005	2010	2005	2010	2005	2010	2006	2010
NonmetalProducts	54.8	↓ 37.6	75.6	↓ 58.0	78.2	↑ 80.6	94.4	↑ 97.1
MetalSmelt	47.0	↓ 20.4	49.5	↓ 28.0	30.8	↓ 24.4	97.1	↓ 96.6
MetalProducts	18.7	↑ 30.0	61.8	↓ 48.6	81.9	↓ 76.5	93.4	↑ 94.4
GenSpecIMch	49.9	↓ 41.3	71.5	↓ 43.7	70.3	↓ 65.2	83.9	↑ 99.4
Transportequip	50.9	↓ 45.8	77.4	↓ 36.7	72.6	↓ 67.0	89.5	↑ 98.0
ElectricalEquip	23.2	↑ 32.5	49.7	↑ 55.3	76.1	↓ 67.5	99.1	↓ 87.7
ElectronicEquip	31.7	↓ 25.8	71.6	↓ 35.8	69.7	↓ 63.1	98.1	↓ 95.1
MeasureInstru	42.3	↓ 30.7	47.9	↑ 48.8	85.3	↓ 55.7	99.7	↓ 99.2
ArtworkOthers	66.1	↓ 26.5	84.2	↓ 44.6	77.8	↓ 67.5	91.1	↑ 97.9
ElectricHeatpower	46.7	↓ 38.7	53.9	↑ 55.1	81.7	↓ 31.7	91.2	↑ 95.4
GasSupply	15.5	↑ 20.6	85.5	↓ 63.9	70.6	↓ 56.0	91.2	↑ 96.5
WaterSupply	27.1	↓ 19.0	48.4	↓ 26.6	74.0	↑ 85.1	98.4	↑ 100
Construction	0.0	- 0.0	0.0	- 0.0	0.0	- 0.0	0.0	- 0.0
Services	0.0	- 0.0	0.0	- 0.0	0.0	- 0.0	0.0	- 0.0
Total	29.9	↓ 20.1	48.7	↓ 21.7	64.3	↓ 34.0	91.7	↑ 95.3

3. Data of outdated production facilities being shut down

In this part, we need to calculate pollution generation reductions caused by outdated production facilities being shut down during 12th FYP. Therefore, we first find out each outdated sector's production facilities being shut down during 11th FYP (Table S7); then we calculate pollutant generation intensity of each outdated sector by using its products outputs and pollution generation data (Table S8); finally, we multiply outdated production facilities that will be shut down during 12th FYP by pollutant generation intensity of each outdated sector and calculate each outdated sector's potential pollution generation reductions, which were listed at right of Table S9.

Table S7 Outdated production facilities being shut down during 11th FYP in China

sectors	units	2007	2008	2009	2010	total
Iron	million tons	0.00	0.00	21.13	36.07	57.20
Steel	million tons	170.19	0.00	16.91	9.35	196.45
coke	million tons	31.47	36.92	18.09	25.87	112.35
iron alloy	million tons	1.29	1.18	1.62	1.72	5.81
calcium carbide	million tons	0.80	1.05	0.47	0.75	3.06
Non-Ferrous Metals	million tons	0.00	0.00	0.31	1.08	1.39
cement	million tons	132.75	85.14	74.16	107.28	399.33
Glass	million cartons	0.00	0.00	6.00	9.94	15.94
Paper	million tons	4.50	0.00	0.51	4.65	9.66
alcohol	million tons	0.42	0.00	0.36	0.68	1.46
monosodium glutamate	million tons	0.07	0.00	0.04	0.20	0.30
citric acid	million tons	0.00	0.00	0.01	0.02	0.03
tanning	million pieces	0.00	0.00	0.00	14.36	14.36
dyeing	million meters	0.00	0.00	0.00	3813.56	3813.56
chemical fiber	million tons	0.00	0.00	0.00	0.67	0.67
coal-fired power	million kilowatts	0.00	0.00	21.13	36.07	57.20

Data sources: enterprises lists of shut-downs outdated production capacity during 2006 to 2010, released by China's Ministry of Industry and Information Technology and National Development and Reform Commission on their homepage, <http://www.miit.gov.cn/n11293472/index.html> and <http://www.sdpc.gov.cn/>.

Table S8 Products outputs and pollution generation of heavy pollution sectors in 2007

Sectors	Products outputs			Pollution generation by sectors (unit: 10 ⁴ tons)				
	values	unit	Sources	COD	NH ₃ -N	SO ₂	NO _x	Sources
Coal-fired power	27229.3	10 ⁸ kilowatts	(1)	142051.3	1126.9	18982738.5	7232440.2	(7)
Iron	47651.6	10 ⁴ tons	(1)	175176.3	3933.8	1205752.7	281642.4	(7)
Steel	48928.8	10 ⁴ tons	(1)	310345.8	6756.5	604079.9	197557.2	(7)
Iron alloy	1746.7	10 ⁴ tons	(2)	20736.7	240.9	75634.2	11743.6	(7)
Copper	349.9	10 ⁴ tons	(3)	27861.1	40.9	3895139.3	708.5	(7)
Electrolytic aluminum	1258.8	10 ⁴ tons	(3)	22291.6	893.2	410312.0	127101.0	(7)
Lead and Zinc	647.4	10 ⁴ tons	(3)	20084.3	323.8	3854692.5	4754.2	(7)
Coke	33553.4	10 ⁴ tons	(1)	411487.0	45561.2	384798.8	184543.1	(7)
Cement	136117.3	10 ⁴ tons	(1)	31778.9	278.2	727570.6	1091993.2	(7)
Glass	53918.1	10 ⁴ cartons	(1)	10707.2	554.7	163183.6	122535.1	(7)
Paper	7792.4	10 ⁴ tons	(1)	1067094.5	5970.3	732568.0	182429.6	(7)
Chemical fiber	2413.8	10 ⁴ tons	(1)	28790.0	290.2	16290.8	11706.7	(7)
Dyeing	675.3	10 ⁸ meters	(1)	2648413.8	20351.2	7369.1	1357.1	(7)
Tanning	7000.0	10 ⁴ pieces	(4)	352668.2	29436.9	15850.4	4471.7	(7)
Alcohol	636.0	10 ⁴ tons	(5)	3154443.8	7112.6	40733.5	12818.0	(7)
Monosodium glutamate	191.3	10 ⁴ tons	(6)	872180.8	163621.3	30685.7	11391.4	(7)

Data sources: (1) China Statistical Yearbook 2008²; (2) China ferroalloy online: <http://www.cnfeol.com/news/statistic/-20080304-/16130122544.aspx>; (3) China nonferrous metals industry yearbook 2008³; (4) China leather market forecast report 2009⁴; (5) Chinese wine: <http://www.zgnj.org/magazine/info8127.html>; (6) Hexun online: <http://www.boyar.cn/-article/2009/05/19/223063.shtml>; (7) China's pollution census database.

Table S9 Outdated production facilities will be shut down during 12th FYP in China

Sectors	Facilities being shut down during 12th FYP		Pollution generation reduction by sectors (unit: tons)			
	values	units	COD	NH ₃ -N	SO ₂	NO _x
Coal-fired power	2000	10 ⁸ kilowatts	1.0	0.0	139.4	53.1
Iron	4800	10 ⁴ tons	17645.7	396.3	121456.8	28370.1
Steel	4800	10 ⁴ tons	30445.5	662.8	59261.3	19380.7
Iron alloy	740	10 ⁴ tons	8785.2	102.1	32042.9	4975.3
Copper	80	10 ⁴ tons	6369.3	9.3	890470.2	162.0
Electrolytic aluminum	90	10 ⁴ tons	1593.7	63.9	29335.2	9087.1
Lead and Zinc	195	10 ⁴ tons	6049.5	97.5	1161052.0	1432.0
Coke	4200	10 ⁴ tons	51507.3	5703.1	48166.6	23099.9
Cement	37000	10 ⁴ tons	8638.3	75.6	197771.5	296830.5
Glass	9000	10 ⁴ cartons	1787.3	92.6	27238.6	20453.6
Paper	1500	10 ⁴ tons	205409.8	1149.3	141015.3	35116.7
Chemical fiber	59	10 ⁴ tons	703.7	7.1	398.2	286.1
Dyeing	55.8	10 ⁸ meters	218851.2	1681.7	608.9	112.1
Tanning	1100	10 ⁴ pieces	55419.3	4625.8	2490.8	702.7
Alcohol	100	10 ⁴ tons	495997.3	1118.4	6404.8	2015.5
Monosodium glutamate	18.2	10 ⁴ tons	82982.3	15567.5	2919.5	1083.8
Total	-	-	1192186.5	31352.9	2720772.1	443161.2

Data sources: outdated production facilities being shut down during 12th FYP are from The Energy Conservation and Emission Reduction 12th Five-Year Plan⁵; the results of each outdated sector's potential pollution generation reductions during 12th FYP are listed at right of Table S9.

4 Changes of structural factors between 2005 and 2010

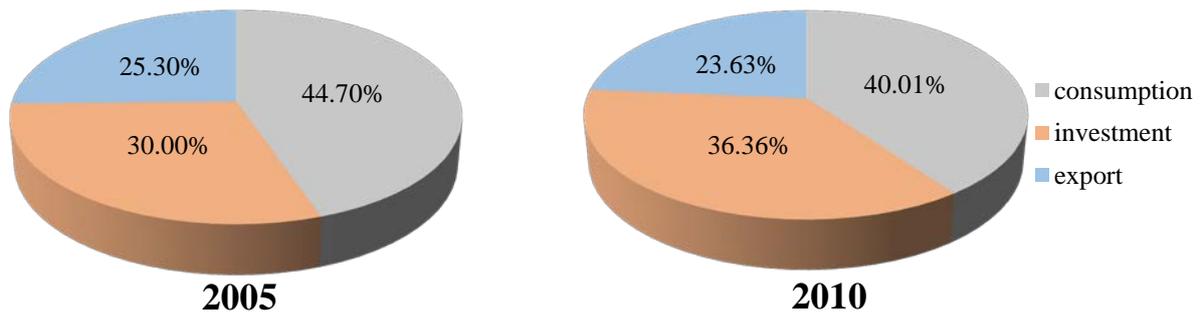


Figure S1 The percentage of three categories of final demand

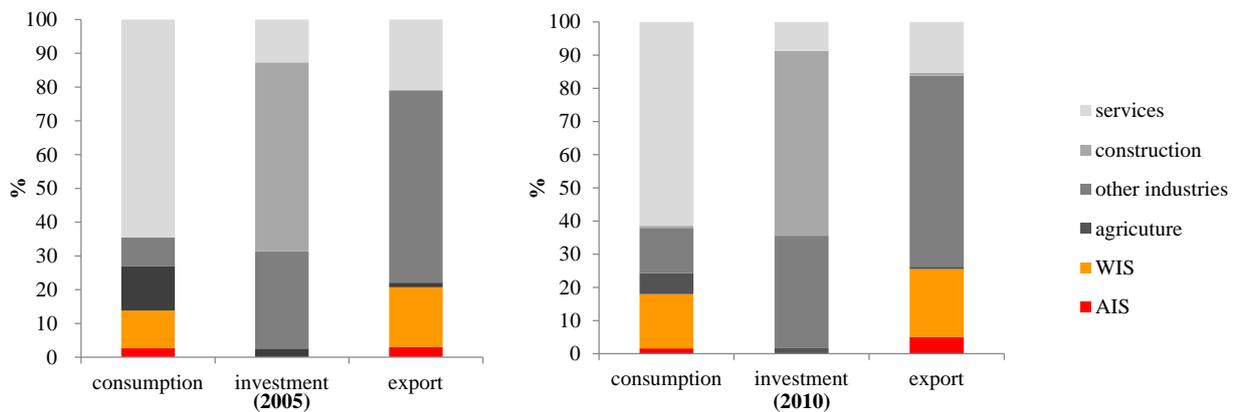


Figure S2 The percentage of heavy-pollution industries on three categories of final demand. To determine the change in the final demand structure, we merged 26 sectors in the MIOTs into four normal aggregated sectors (services, construction, other industries, agriculture) and two pollution-intensive sectors (wastewater-intensive sectors and atmospheric-intensive sectors). wastewater-intensive sectors (WIS) mainly include *food and tobacco, textiles, papermaking and printing, chemical products*; as well as atmospheric-intensive sectors (AIS) mainly include *nonmetallic mineral products, metal smelting and rolling, electric and heat power*.

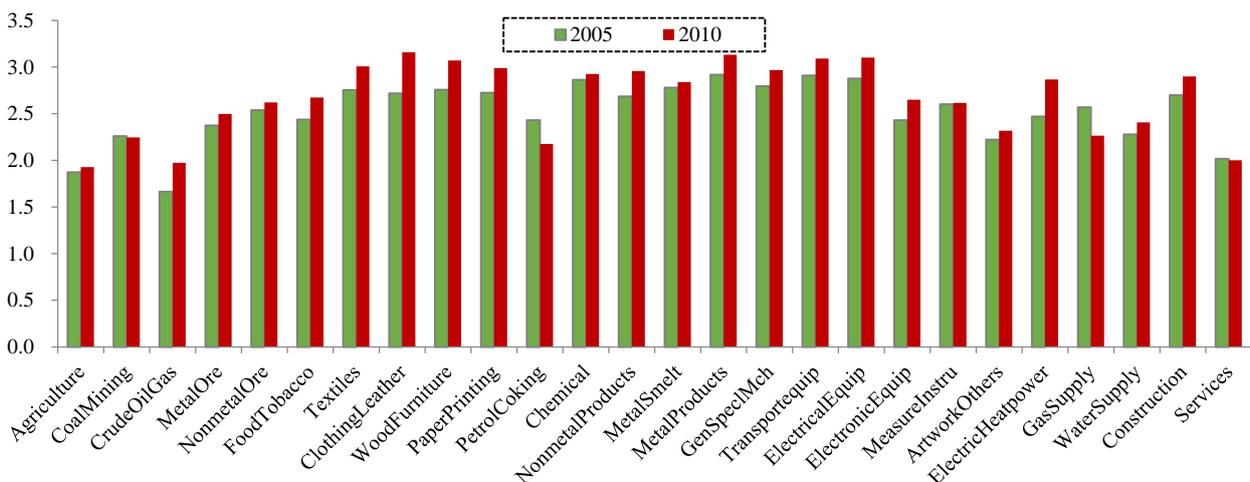


Figure S3 Changes of total input coefficients between 2005 and 2010. To reflect the change in the production structure, we defined the Total Input Multiplier (TIM) as the gross of intermediate inputs of the other sectors to one sector to produce one unit of final goods, which is the summation of the Leontief inverse matrix by columns and indicates a sector's magnitude of material needs throughout the supply chain.

Table S10 Prediction China's GDP value in 2014 and 2015. China are experiencing terrible annoyances in its social, economy and environment problem due to fast and poor-quality GDP growth, which regard investment and real estate as motive force of China's economy. From 2012, the Chinese central government think China's economy is entering to "The New Normal" stage and lowered China's economic growth rate (about 7%) in its 12th Five-Year Plan.

years	Average growth rate of GDP per year (unit:%)	Gross GDP(unit:10 ⁸ CNY)
2010	10.4	473600*
2011	9.3	517645
2012	7.7	557503
2013	7.7	600431
2014	7 (predicated in 12th FYP ⁶)	642461
2015	7 (predicated in 12th FYP ⁶)	687433

Data sources: the growth rate of GDP during 2011-2013 are from China Statistical Yearbook 2013⁷, as well as growth rate of GDP of 2014 and 2015 are from 12th Five-Year Plan for national economic and social development, released by National Development and Reform Commission of China.

*notes: The values of GDP used in this paper differ from public data because we define GDP as the aggregation of gross consumption, export and fixed capital formation from the MIOTs, which do not include inventories or imports. The GDP in 2010 are from 2010 MIOTs, and the GDP from 2011 to 2015 are multiply GDP growth rates by previous year's GDP values.

Table S11 Existing data in the first three years of 12th FYP and the gaps to achieve goals in 2015 (unit: 10⁶ tons)

	Years	COD	NH ₃ -N	SO ₂	NO _x
Baseline data	2010	3.56	0.23	17.03	13.73
	2011	3.55	0.28	20.17	17.30
Existing data	2012	3.38	0.26	19.12	16.58
	2013	3.19	0.25	18.35	15.46
	2013 ÷ 2010 × 100%	89.8%	108.1%	107.8%	112.6%
Target	2015	3.20	0.19	15.32	11.67
	2015 ÷ 2010 × 100%	90%	85%	90%	85%

Data sources: emission data of major pollutants during 2010 to 2013 are from *Annual Statistic Report on Environment in China*⁸, while emission data of major pollutants in 2015 are predicted according to the Energy Conservation and Emission Reduction 12th Five-Year Plan⁵.

5. Structural decomposition results between 2005 and 2010

The detailed structural decomposition results on the emission changes of four major pollutants during 11th FYP are presented in Table S12-S15. Each driving factor's contributions on emission changes are converted to percentage values based on sector's emission values in 2005.

Table S12 Driving factor's contributions on COD emission changes at the sector level (unit: %)

sectors	end-of-pipe abatement efficiency (ΔE)	pollutant generation intensity (ΔF)	production structure (ΔL)	final demand structure (ΔM)	final demand composition (ΔN)	total final demand (ΔG)	total change(Δ Q)
CoalMining	97.5	-82.7	-15.3	-0.7	2.4	73.3	74.6
CrudeOilGas	97.2	-74.0	-11.0	4.7	0.3	77.5	94.8
MetalOre	-80.8	-95.7	72.4	6.2	5.8	48.3	-43.9
NonmetalOre	-76.3	-32.2	-2.1	-0.9	8.2	45.3	-58.0
FoodTobacco	-48.0	-61.3	27.4	18.7	-8.1	53.9	-17.4
Textiles	-38.6	-23.0	22.8	-11.5	-6.7	57.7	0.7
ClothingLeather	212.9	-83.1	32.2	1.2	-13.3	112.9	262.7
WoodFurniture	-33.6	-81.2	16.2	2.4	1.5	47.6	-47.0
PaperPrinting	-37.5	-57.9	19.5	-10.1	-3.5	49.0	-40.4
PetrolCoking	11.9	-70.4	-3.4	2.4	0.6	57.1	-1.9
Chemical	-34.2	-55.6	0.5	20.9	-0.4	54.6	-14.2
NonmetalProducts	-29.2	-90.8	20.1	-1.1	11.0	48.9	-41.0
MetalSmelt	-70.4	-33.2	1.2	10.1	6.9	50.1	-35.4
MetalProducts	53.7	-88.4	18.7	-26.3	4.6	62.8	25.2
GenSpeclMch	-16.5	-91.2	27.0	-7.1	11.4	52.5	-23.8
Transportequip	-12.8	-133.7	26.7	87.9	6.9	66.2	41.3
ElectricalEquip	39.2	-110.6	14.9	23.0	2.0	64.5	33.1
ElectronicEquip	-28.7	-5.3	26.6	10.6	-4.5	72.5	71.2
MeasureInstru	-21.9	-100.6	11.2	8.2	0.6	45.5	-57.0
ArtworkOthers	-105.1	13.1	17.9	15.5	1.3	57.6	0.4
ElectricHeatpower	-12.8	-100.5	7.9	0.7	0.9	45.2	-58.5
GasSupply	19.7	-175.0	26.5	20.1	-5.0	42.5	-71.2
WaterSupply	-37.9	8.9	-53.6	34.4	-3.5	59.1	7.4
Total	-35.6	-58.6	16.6	5.1	-2.8	52.8	-22.6

Table S13 Driving factor's contributions on NH₃-N emission changes at the sector level (unit: %)

sectors	end-of-pipe abatement efficiency (ΔE)	pollutant generation intensity (ΔF)	production structure (ΔL)	final demand structure (ΔM)	final demand composition (ΔN)	total final demand (ΔG)	total change (ΔQ)
CoalMining	-41.4	127.7	-18.2	-1.1	3.1	91.6	-41.4
CrudeOilGas	-103.2	3.5	-7.2	2.7	0.4	45.2	-103.2
MetalOre	-111.9	143.0	104.0	12.1	11.4	115.3	-111.9
NonmetalOre	-40.1	-82.3	-2.0	-0.9	7.8	41.5	-40.1
FoodTobacco	-51.2	-84.1	25.3	17.1	-7.3	46.1	-51.2
Textiles	-66.4	8.2	23.1	-11.6	-6.8	58.6	-66.4
ClothingLeather	-29.5	174.0	33.1	1.2	-13.7	117.0	-29.5
WoodFurniture	-33.0	-102.0	15.3	2.2	1.4	41.9	-33.0
PaperPrinting	-32.8	-62.8	19.5	-10.1	-3.5	49.0	-32.8
PetrolCoking	-93.0	-5.6	-2.9	1.9	0.6	46.4	-93.0
Chemical	-64.0	-61.6	0.3	18.6	-0.2	44.4	-64.0
NonmetalProducts	-32.8	-29.1	23.1	-1.2	13.6	65.9	-32.8
MetalSmelt	-40.7	-74.6	1.1	9.7	6.6	46.8	-40.7
MetalProducts	-44.6	110.0	24.1	-33.8	5.8	89.3	-44.6
GenSpecIMch	-38.2	-82.2	26.1	-7.0	11.0	48.8	-38.2
Transportequip	-98.7	-54.4	26.5	86.8	6.7	64.0	-98.7
ElectricalEquip	16.2	-33.3	16.6	26.2	2.8	80.5	16.2
ElectronicEquip	-161.3	201.7	31.1	13.0	-5.4	94.1	-161.3
MeasureInstru	1.6	-104.4	11.9	9.0	0.4	51.1	1.6
ArtworkOthers	-66.0	-29.5	17.8	15.4	1.3	56.6	-66.0
ElectricHeatpower	2.1	-82.2	9.0	0.6	1.1	54.4	2.1
GasSupply	-15.2	-149.5	25.8	19.4	-4.8	39.7	-15.2
WaterSupply	-40.7	-42.2	-44.2	28.0	-2.4	45.8	-40.7
Total	-56.5	-60.5	8.4	12.8	-1.4	46.9	-56.5

Table S14 Driving factor's contributions on SO₂ emission changes at the sector level (unit: %)

sectors	end-of-pipe abatement efficiency (ΔE)	pollutant generation intensity (ΔF)	production structure (ΔL)	final demand structure (ΔM)	final demand composition (ΔN)	total final demand (ΔG)	total change (ΔQ)
CoalMining	-2.7	-63.0	-12.0	-0.2	1.6	52.5	-23.8
CrudeOilGas	57.7	-102.0	-8.9	3.6	0.4	59.8	10.6
MetalOre	-150.3	34.4	81.6	7.9	7.4	67.8	48.9
NonmetalOre	61.2	-146.4	-2.2	-1.1	8.8	51.6	-28.1
FoodTobacco	-5.4	-84.3	29.0	19.9	-8.8	59.7	10.2
Textiles	-7.5	-67.5	21.8	-11.0	-6.4	54.0	-16.5
ClothingLeather	5.4	-99.0	18.7	0.3	-7.5	51.0	-31.0
WoodFurniture	1.3	-105.3	16.7	2.5	1.6	50.7	-32.5
PaperPrinting	-5.7	-45.1	22.6	-11.8	-3.9	61.2	17.4
PetrolCoking	-75.9	10.7	-3.3	2.3	0.6	55.4	-10.3
Chemical	-13.8	-71.2	0.6	21.2	-0.4	55.9	-7.8
NonmetalProducts	3.0	-97.3	21.4	-1.1	12.2	56.4	-5.5
MetalSmelt	-26.2	-35.6	1.2	11.4	7.9	61.9	20.7
MetalProducts	-8.1	-17.0	19.2	-27.0	4.7	65.4	37.2
GenSpecIMch	-7.7	-81.7	28.3	-7.4	12.1	57.9	1.5
Transportequip	-7.2	-176.5	25.3	81.4	5.7	53.9	-17.4
ElectricalEquip	-8.8	-122.2	13.1	19.4	1.2	46.9	-50.5
ElectronicEquip	-6.8	-124.1	20.7	7.4	-3.4	44.6	-61.6
MeasureInstru	-20.2	-126.1	10.4	7.2	0.8	38.7	-89.2
ArtworkOthers	-22.5	6.9	21.7	18.8	1.8	80.0	106.6
ElectricHeatpower	-91.6	5.5	8.8	0.6	1.0	52.7	-22.9
GasSupply	-24.2	-76.5	30.4	24.3	-6.1	59.0	6.8
WaterSupply	10.1	-97.2	-43.5	27.5	-2.3	44.7	-60.6
Total	-62.1	-20.6	9.3	3.3	2.4	54.8	-12.9

Table S15 Driving factor's contributions on NO_x emission changes at the sector level (unit: %)

sectors	end-of-pipe abatement efficiency (ΔE)	pollutant generation intensity (ΔF)	production structure (ΔL)	final demand structure (ΔM)	final demand composition (ΔN)	total final demand (ΔG)	total change (ΔQ)
CoalMining	1.0	-59.6	-12.3	-0.3	1.7	54.4	-15.1
CrudeOilGas	1.1	-60.2	-8.5	3.4	0.4	55.9	-8.0
MetalOre	5.0	-161.9	75.4	6.7	6.3	54.6	-13.9
NonmetalOre	-1.3	-106.2	-2.1	-0.9	8.2	45.6	-56.8
FoodTobacco	1.1	-85.8	29.4	20.2	-8.9	61.1	17.1
Textiles	4.6	-78.6	21.9	-11.0	-6.4	54.3	-15.2
ClothingLeather	1.3	-90.5	19.0	0.4	-7.6	52.2	-25.2
WoodFurniture	0.9	-83.9	17.7	2.7	1.8	56.7	-4.1
PaperPrinting	4.4	-67.0	21.8	-11.3	-3.8	58.0	2.0
PetrolCoking	-8.1	-2.6	-4.1	2.9	0.6	69.9	58.7
Chemical	6.6	-86.3	0.6	21.5	-0.4	57.4	-0.5
NonmetalProducts	4.1	-29.1	25.0	-1.3	15.3	76.6	90.6
MetalSmelt	-0.6	-53.1	1.2	11.7	8.1	64.2	31.5
MetalProducts	1.1	-48.3	18.0	-25.3	4.5	59.5	9.5
GenSpecIMch	22.8	-60.2	32.1	-8.0	13.8	73.0	73.4
Transportequip	7.7	-200.5	24.9	79.9	5.5	50.9	-31.6
ElectricalEquip	-13.2	-71.7	14.5	22.2	1.8	60.5	14.2
ElectronicEquip	-2.7	-103.0	22.2	8.3	-3.7	51.8	-27.0
MeasureInstru	-0.3	-147.9	10.3	7.1	0.8	38.2	-91.7
ArtworkOthers	12.2	0.9	23.1	20.0	1.9	88.4	146.6
ElectricHeatpower	5.3	-47.0	10.3	0.5	1.2	65.0	35.3
GasSupply	7.4	-68.1	33.3	27.3	-6.9	71.1	64.1
WaterSupply	1.2	-75.2	-45.8	29.1	-2.6	48.0	-45.3
Total	4.3	-51.5	10.6	3.2	2.5	64.7	33.8

6. Sensitivity analysis

Methodology. Uncertainties of SDA method mainly come from the choice of base year, decomposition method, decomposition model, respectively, as well as the aggregation level of the data⁹. Due to the lack of necessary data, we conduct a sensitivity analysis of the sectors' aggregation as previous studies¹⁰. The input output tables used in our paper totally have 26 sectors. All data used in SDA model are aggregated to 10 sectors, 6 sectors and 3 sectors respectively. Then we decompose four main pollutants emission change during 11th FYP period by using different data sets to test if the decomposition results will change a lot due to sector's aggregation. As presented in Fig S4, sector's aggregation have little impact on the results for most driving factors except pollutant generation intensity, presenting more pollution reduction when sectors are aggregated from 10 sectors to 6 sectors for SO₂ and NO_x. Overall, sector's aggregation may have a little influence on our results, but will not affect our conclusion presented above.

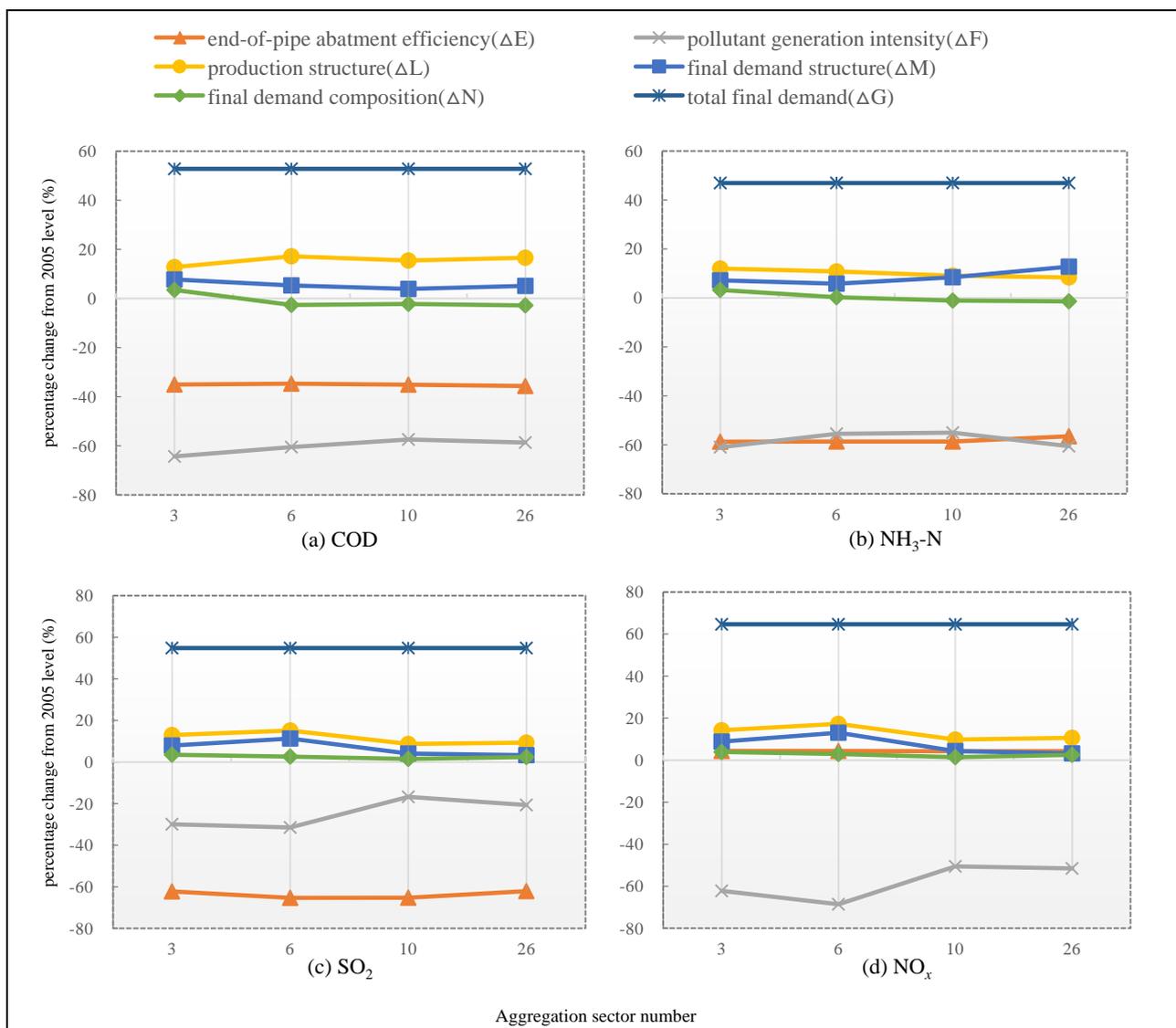


Figure S4 Sensitivity analysis results of SDA decomposition with different aggregation sector levels

Data. Uncertainties of data mainly come from emission and generation of four pollutants. These data in year of 2005 and 2010 totally come from *Annual Statistic Report on Environment in China*, released by MEP. It must be admitted that some certain errors will exist in this process of data collection and estimation, especially, data of pollution emission and generation may possibly be “underestimated” on purpose by industrial enterprises and local governments owing to evade assessment and punishment from central government and MEP as we discussed in manuscript. So, to analyze the influence of these “underestimated” on our results and conclusion, a sensitivity analysis is conducted—increasing emissions of each sector in year of 2005 and 2010 with 5%, 10% and 20% respectively with other factors keeping constant. As presented in Table S16, when sector’s emissions in year of 2005 and 2010 increased with 5%, 10% and 20% with other factors keeping constant, we find that the contributions of all six determinants for changes of pollutants emissions increase gradually with increase of pollutants emission at the same time. Also, we will get the same results when we increase the generation of four pollutants instead of emissions. Fortunately, uncertainties of pollution data may affect our structural decomposition results in 11th FYP, however, will not significantly affect our conclusions according to results of sensitivity analysis.

Table S16 Sensitivity analysis results of SDA decomposition when original emission value of four pollutants increased by 5%, 10% and 20% respectively during 11th FYP.

pollutants	Increment	end-of-pipe	pollutant	production	final demand	final demand	total final	total change
		abatement	generation	structure	structure	composition	demand	
		efficiency	intensity	(ΔL)	(ΔM)	(ΔN)	(ΔG)	(ΔQ)
		(ΔE)	(ΔF)					
COD	Original Value (OV)	-35.62	-58.64	16.57	5.12	-2.81	52.77	-22.60
	OV \times (1+5%)	-37.40	-61.57	17.40	5.38	-2.95	55.41	-23.73
	OV \times (1+10%)	-39.18	-64.50	18.23	5.63	-3.09	58.05	-24.86
	OV \times (1+20%)	-42.75	-70.36	19.89	6.15	-3.37	63.32	-27.12
NH ₃ -N	Original Value (OV)	-56.51	-60.54	8.40	12.78	-1.39	46.93	-50.33
	OV \times (1+5%)	-59.34	-63.56	8.82	13.42	-1.46	49.27	-52.85
	OV \times (1+10%)	-62.16	-66.59	9.25	14.06	-1.52	51.62	-55.36
	OV \times (1+20%)	-67.81	-72.65	10.09	15.33	-1.66	56.31	-60.39
SO ₂	Original Value (OV)	-62.08	-20.63	9.32	3.31	2.38	54.82	-12.87
	OV \times (1+5%)	-65.18	-21.66	9.79	3.47	2.50	57.56	-13.51
	OV \times (1+10%)	-68.28	-22.69	10.26	3.64	2.62	60.31	-14.15
	OV \times (1+20%)	-74.49	-24.75	11.19	3.97	2.85	65.79	-15.44
NO _x	Original Value (OV)	4.32	-51.53	10.65	3.23	2.48	64.66	33.81
	OV \times (1+5%)	4.53	-54.10	11.18	3.39	2.61	67.90	35.50
	OV \times (1+10%)	4.75	-56.68	11.71	3.55	2.73	71.13	37.19
	OV \times (1+20%)	5.18	-61.83	12.77	3.88	2.98	77.60	40.57

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